

FRESHWATER FISHES OF SOUTHERN KERALA WITH NOTES ON THE DISTRIBUTION OF ENDEMIC AND ENDANGERED SPECIES¹

K. RAJU THOMAS², M. JOHN GEORGE³ AND C. R. BIJU²

Key words: Freshwater fishes, southern Kerala, distribution, endemic, endangered

Freshwater fishes were collected from rivers of southern Kerala from November 1996 to April 2000. A total of 117 species belonging to 58 genera, 27 families, and 10 orders were recorded. The most abundant order was Cypriniformes, followed by Perciformes and Siluriformes. The distribution of 36 endangered and 11 endemic species is also included. Most of the endangered fish are restricted to one or two rivers.

INTRODUCTION

The Western Ghats are one of the selected biodiversity hotspots in the world. According to the distribution of hill-stream fishes, Bhimachar (1945) has divided the Western Ghats into three major regions. These geographic regions are northern division (Surat to Goa), central division (Goa to Nilgiri mountains) and southern division (south of Palghat Gap). The Western Ghats form the major watershed in Kerala and 44 rivers originate from it. Of these, 19 rivers and a portion of Bharathapuzha river flow through the southern part of Kerala. The freshwater fishes collected from these rivers and the distribution of endemic and endangered species are given in this paper.

The first monumental work on FISHES OF MALABAR was by Francis Day (1865). The next ichthyofaunal study in southern Kerala was by Pillay (1929) followed by John (1936). Hora and Law (1941) published a comprehensive list of freshwater fishes from Travancore. Other intensive freshwater fish fauna studies were conducted in southern Kerala by Raj (1941), Herre (1942), Silas (1950, 1951, 1954, 1958),

Menon (1950, 1951), Rita *et al.* (1978), Rema Devi and Indra (1984), Rema Devi and Menon (1992), Pethiyagoda and Kottelat (1994), Menon and Rema Devi (1995), Menon and Jacob (1996), Easa and Shaji (1996), Zacharias *et al.* (1996), Biju *et al.* (1999), Ajith Kumar *et al.* (1999) and Raju Thomas *et al.* (1999, 2000a, b).

Though there are a number of publications on freshwater fish fauna from southern Kerala, studies on fish assemblages have been carried out only in a few river segments. We provide an updated assessment of the conditions and status of the freshwater fishes in southern Kerala, with special reference to species regarded as endemic and endangered.

STUDY AREA

Kerala is situated in the southwest corner of India (8° 17' 30"-12° 47' 40" N and 74° 51' 57"-77° 24' 47" E). The Western Ghats, as a natural wall on the eastern side, and the Arabian Sea on the western side, flank the State. The Western Ghats protect the State from the dry winds of the eastern plateau and provide steady rainfall during the monsoon. This range has only one major discontinuity — the Palghat Gap in Kerala, dividing the state into two parts: north and south of Palghat Gap. We selected the southern part as our study area. Natural topographic features such as mountain ridges and valleys divide southern Kerala into a number of divisions: Agasthyamalai Range, Pandalam

¹Accepted August, 2001

²Bombay Natural History Society, Hornbill House, S.B. Singh Road, Mumbai 400 023, Maharashtra, India. Present address: Mar Thoma College, Thiruvalla 689 103, Kerala, India.

³Mar Thoma College for Women, Perumbavoor, Ernakulam 683 542, Kerala, India.

Hills, Cardamom Hills, The High Ranges, and the Nelliampathy and Anaimalai Hills (Nair 1991). The land resources of these areas generally fall into four well defined natural divisions: 1) Lowland (< 75 m above msl), 2) Midland (75 to 500 m above msl), 3) Highland (500 to 750 m above msl), and 4) High Ranges (> 750 m above msl).

The highest peak in the Western Ghats, the Anamudi (2,690 m above msl) is situated in the study area. Most of the reserve forests and sanctuaries of the study area are in the Highland region. Eravikulam is the only national park in this area. The study area includes the following sanctuaries: Neyyar, Chendurni, Peppara, Periyar, Idukki, Thattekkad, Chimmony, Parambikulam, and Peechi-Vazhani. In the present study, fishes were collected from 19 rivers and also from a portion of the Bharathapuzha river. Specimens were collected from all the rivers except Peppara Sanctuary area of Karamana river, Chendurni Sanctuary of Kallada river, and Periyar Sanctuary area of Periyar river.

METHODS

A survey was carried out during November 1996 to April 2000 in the rivers flowing through southern Kerala. Studies were mainly done in the post-monsoon periods. However, some collections were made during pre-monsoon and monsoon periods. 1: 50,000 topographical maps of the Survey of India were used to trace the river system and pinpoint the collection sites. Samples were collected from several approachable areas of each stream of the main river. As our study period was post-monsoon, the water was rarely turbid. Fish samples were collected by using cast net, scoop net, gill net, and a circular net with very small mesh size and sinkers on the edge. Constant efforts were made to reduce statistical bias. Samples were preserved in 10% formaline and kept in the field station

for identification and further studies. The works of Jayaram (1981, 1999), Datta Munshi and Srivastava (1988), Talwar and Jhingran (1991), and Menon (1998) were followed for the identification of fishes.

According to the IUCN criteria, the fishes of Kerala can be grouped into two categories: Threatened and Non-threatened. The category Threatened is further divided into (1) Critically Endangered (CR), (2) Endangered (EN), and (3) Vulnerable (VU). The Non-threatened category is divided into (1) Low Risk-nearly threatened (LR-nt) and (2) Low Risk- of least concern (LR-lc). These criteria are more applicable to a single river. Since we had covered 20 rivers, we adopted the IUCN criteria with some modifications. In our analysis, we classified the species based on restricted distribution of the species, area of occupancy of the species, and the number of species recorded. The criteria adopted are as follows:

Critically Endangered: (a) species with distribution restricted to a single river, (b) area of occupancy limited to a single location in that river, and (c) the number of species estimated to be less than five in the collection site.

Endangered: (a) species with distribution restricted to 1-3 rivers, (b) area of occupancy of less than 5 collection sites in the rivers from where they are recorded, and (c) the number of species estimated to be less than 10 in the collection sites.

Vulnerable: (a) species with distribution restricted to 4-8 rivers, (b) area of occupancy of less than 10 collection sites in the rivers from where they were collected, and (c) the number of species estimated to be less than 10 in the collection sites.

Low Risk-nearly threatened: (a) species with wide distribution in 8-15 rivers, (b) area of occupancy of more than 20 collection sites in the rivers from where they were recorded, and (c) the number of species estimated to be less than 15 in the collection sites.

Low Risk-least concern: (a) species with wide distribution in more than 15 rivers, (b) area of occupancy of more than 20 collection sites in the rivers from where they were recorded, and (c) the number of species estimated to be more than 15 in the collection sites.

RESULTS AND DISCUSSION

A total of 117 species of freshwater fishes, belonging to 58 genera of 27 families and 10 orders were recorded from the rivers flowing through southern Kerala (Table 1). The most abundant order was Cypriniformes, followed by Perciformes and Siluriformes. The family with the maximum number of representatives was Cyprinidae. The most abundant genus was *Puntius* followed by *Mystus* and *Nemacheilus*.

The list of Critically Endangered and Endangered species is given in Table 2. Under these categories, 26 species were recorded from a single river alone. All these species are considered threatened, as their distribution is restricted and there is an alarming decrease in their numbers. The following are considered as endemic species: *Puntius denisonii* (Day), *Osteobrama bakeri* Day, *Garra surendranathanii* Shaji et al, *Osteochilus longidorsalis* Pethiyagoda and Kottelat, *Chela fasciata* Silas, *Travancoria jonesi* Hora, *Nemacheilus pambarensis* Rema Devi and Indra, *N. keralensis* Rita and Nalbant, *Horabagrus brachysoma* (Günther), *H. nigricollaris* Pethiyagoda and Kottelat, and *Batasio travancoria* Hora and Law. Distribution of most of these species is given in Table 2. *Puntius denisonii* inhabit Bharathapuzha, Chalakudy, Periyar, Pamba and Achankovil rivers, *Osteobrama bakeri* inhabit Bharathapuzha, Karuvannur, Chalakudy, Periyar, Muvattupuzha, Meenachil, Achankovil and Manimala rivers, while *Horabagrus brachysoma* is distributed in almost all the river systems of southern Kerala.

TABLE I
SYSTEMATIC LIST, ABUNDANCE AND STATUS
OF FRESHWATER FISHES COLLECTED
FROM SOUTHERN KERALA

No.	Name of Species	Abundance	Status
ORDER I: Osteoglossiformes			
1. Family: Notopteridae			
1	<i>Notopterus notopterus</i> (Pallas)	+	VU
ORDER II: Anguilliformes			
2. Family: Anguillidae			
2	<i>Anguilla bengalensis</i> (Gray)	+++	LR-nt
3	<i>A. bicolor bicolor</i> McClelland	+	VU
3. Family: Ophichthidae			
*4	<i>Pisodonophis boro</i> (Ham.)	+	EN
ORDER III: Clupeiformes			
4. Family: Clupeidae			
5	<i>Dayella malabarica</i> (Day)	+++	LR-lc
ORDER IV: Cypriniformes			
5. Family: Cyprinidae			
6	<i>Catla catla</i> (Ham.)	++	INTR
7	<i>Cirrhinus mrigala</i> (Ham.)	++	INTR
8	<i>Ctenopharyngodon idellus</i> (Val.)	++	INTR
9	<i>Cyprinus carpio communis</i> L.	+++	INTR
10	<i>Hypseobarbus curmuca</i> (Ham.)	++	VU
11	<i>H. kolus</i> (Sykes)	++	VU
12	<i>H. kurali</i> Menon and Rema Devi	+++	VU
*13	<i>H. thomassi</i> (Day)	+	EN
14	<i>Labeo calbasu</i> (Ham.)	+	VU
15	<i>L. rohita</i> (Ham.)	+++	INTR
16	<i>Osteobrama bakeri</i> Day	++	VU
*17	<i>O. cotio peninsularis</i> Silas	+	EN
*18	<i>Osteochilus longidorsalis</i> Pethiyagoda and Kottelat	+	EN
*19	<i>O. nashii</i> (Day)	+	EN
*20	<i>O. thomassi</i> (Day)	+	EN
21	<i>Barbodes carnaticus</i> (Jerdon)	++	VU
22	<i>B. sarana subnasutus</i> (Val.)	+++	LR-lc
23	<i>Puntius amphibius</i> (Val.)	++++	LR-lc
24	<i>P. arulius</i> (Jerdon)	+++	VU
25	<i>P. chola</i> (Ham.)	+++	LR-lc
26	<i>P. conchoni</i> (Ham.)	++	LR-nt
27	<i>P. denisonii</i> (Day)	+	VU
28	<i>P. dorsalis</i> (Jerdon)	++	VU
29	<i>P. filamentosus</i> (Val.)	++++	LR-lc
30	<i>P. jerdoni</i> (Day)	++	VU
31	<i>P. melanampyx</i> (Day)	+++	LR-lc

FRESHWATER FISHES OF SOUTHERN KERALA

TABLE I (CONTD.)
SYSTEMATIC LIST, ABUNDANCE AND STATUS OF FRESHWATER FISHES COLLECTED
FROM SOUTHERN KERALA

No.	Name of Species	Abundance	Status	No.	Name of Species	Abundance	Status
*32	<i>P. melanostigma</i> (Day)	+	EN	ORDER V: Siluriformes			
*33	<i>P. ophicephalus</i> Raj	+	CR	8. Family: Bagridae			
34	<i>P. parrah</i> Day	++	LR-nt	73	<i>Horabagrus brachysoma</i> (Günther)	++	VU
35	<i>P. sophore</i> (Ham.)	++	LR-nt	*74	<i>H. nigricollaris</i> Pethiyagoda and Kottelat	+	CR
36	<i>P. ticto</i> (Ham.)	++++	LR-lc	*75	<i>Batasio travancoria</i> Hora and Law	++	EN
37	<i>P. vittatus</i> Day	++++	LR-lc	76	<i>Mystus armatus</i> Day	+++	LR-nt
38	<i>Tor khudree</i> (Sykes)	++	VU	*77	<i>M. bleekeri</i> (Day)	+	EN
*39	<i>Chela fasciata</i> Silas	+	EN	78	<i>M. cavasius</i> (Ham.)	++	LR-nt
40	<i>Salmostoma acinaces</i> (Val.)	++	VU	79	<i>M. gulio</i> (Ham.)	+++	LR-lc
41	<i>S. boopis</i> (Day)	+++	LR-nt	80	<i>M. malabaricus</i> (Jerdon)	++	VU
*42	<i>S. clupeiodes</i> Bloch	+	EN	*81	<i>M. montanus</i> (Jerdon)	+	EN
43	<i>Amblypharyngodon melettinus</i> (Val.)	++++	LR-lc	82	<i>M. oculatus</i> (Val.)	++++	LR-lc
44	<i>Barilius bakeri</i> Day	+++	LR-nt	*83	<i>M. punctatus</i> (Jerdon)	+	EN
45	<i>B. bendelisis</i> (Ham.)	++	VU	*84	<i>M. vittatus</i> (Bloch)	+	EN
*46	<i>B. canarensis</i> (Jerdon)	+	EN	9. Family: Claridae			
47	<i>B. gatensis</i> (Val.)	+++	LR-nt	85	<i>Clarias dussumieri</i> (Val.)	++	VU
48	<i>Danio aequipinnatus</i> (McClelland)	++++	LR-lc	10. Family: Claridae			
49	<i>D. malabaricus</i> (Jerdon)	++++	LR-lc	86	<i>Heteropneustes fossilis</i> (Bloch)	++	VU
50	<i>Parluciosoma daniconius</i> (Ham.)	++++	LR-lc	11. Family: Siluridae			
51	<i>Esomus danricus</i> (Ham.)	++	VU	87	<i>Ompok bimaculatus</i> (Bloch)	+++	LR-nt
*52	<i>E. thermoicos</i> (Val.)	+	EN	*88	<i>O. malabaricus</i> (Val.)	++	EN
*53	<i>Garra maclellandi</i> (Jerdon)	++	EN	89	<i>Wallago attu</i> (Schneider)	+++	LR-nt
*54	<i>G. menoni</i> Rema Devi and Indra	++	EN	12. Family: Schilbeidae			
55	<i>G. mullya</i> (Sykes)	++++	LR-lc	*90	<i>Pseudeutropius mitchelli</i> Günther	+	EN
*56	<i>G. hughi</i> Silas	+	EN	13. Family: Sisoridae			
57	<i>G. gotyla stenorhynchus</i> (Jerdon)	++	VU	*91	<i>Glyptothorax annandalei</i> Hora	+	EN
*58	<i>G. surendranathanii</i> Shaji et al.	++	EN	92	<i>G. madraspatanus</i> (Day)	++	VU
*59	<i>Horabiosia joshuai</i> Silas	+	CR	*93	<i>G. lonah</i> (Sykes)	+	EN
6. Family: Balitoridae				ORDER VI: Salmoniformes			
60	<i>Bhavana australis</i> (Jerdon)	++	VU	14. Family: Salmonidae			
*61	<i>Balitora mysorensis</i> Hora	+	CR	94	<i>Salmo gairdnerii irredius</i> Richardson	+	INTR
*62	<i>Travancoria jonesi</i> Hora	+	EN	ORDER VII: Cyprinodontiformes			
63	<i>Nemacheilus denisoni denisoni</i> Day	++	VU	15. Family: Belontiidae			
*64	<i>N. pambarensis</i> Rema Devi and Indra	+	EN	95	<i>Xenentodon cancila</i> (Ham.)	++++	LR-lc
*65	<i>N. evezardi</i> Day	+	EN	16. Family: Aplocheilidae			
66	<i>N. guentheri</i> Day	+++	LR-nt	96	<i>Aplocheilus lineatus</i> (Val.)	++++	LR-lc
*67	<i>N. keralensis</i> (Rita et al.)	++	EN	17. Family: Poeciliidae			
*68	<i>N. monilis</i> Hora	+	CR	97	<i>Lebistes reticulata</i> Peters	++	INTR
*69	<i>N. semiarmatus</i> Day	++	EN	ORDER VIII: Syngnathiformes			
70	<i>N. triangularis</i> Day	+++	LR-lc	18. Family: Syngnathidae			
7. Family: Cobitidae				98	<i>Microphis cuncalus</i> (Ham.)	+++	LR-lc
*71	<i>Pangio goaensis</i> (Tilak)	+	EN				
72	<i>Lepidocephalus thermalis</i> (Val.)	++++	LR-lc				

FRESHWATER FISHES OF SOUTHERN KERALA

TABLE 1 (CONTD.)
SYSTEMATIC LIST, ABUNDANCE AND STATUS OF FRESHWATER FISHES COLLECTED
FROM SOUTHERN KERALA

No.	Name of Species	Abundance	Status	No.	Name of Species	Abundance	Status
	ORDER IX: Perciformes				23. Family: Anabantidae		
	19. Family: Ambassidae			109	<i>Anabas testudineus</i> (Bloch)	+++	LR-lc
99	<i>Chanda nama</i> (Ham.)	++	LR-nt		24. Family: Belontiidae		
100	<i>Parambassis dayi</i> (Bleeker)	++++	LR-lc	110	<i>Macropodus cupanus</i> (Val.)	+++	LR-lc
101	<i>P. thomassi</i> (Day)	++	LR-nt		25. Family: Channidae		
	20. Family: Nandidae			111	<i>Channa marulius</i> (Ham.)	+++	VU
102	<i>Nandus nandus</i> (Ham.)	+++	LR-lc	112	<i>C. orientalis</i> Bloch and Schneider	++	VU
103	<i>Pristolepis marginata</i> Jerdon	++	VU	113	<i>C. punctatus</i> (Bloch)	++	VU
	21. Family: Cichlidae			114	<i>C. striatus</i> (Bloch)	+++	VU
104	<i>Etroplus maculatus</i> (Bloch)	++++	LR-lc		26. Family: Mastacembelidae		
105	<i>E. suratensis</i> (Bloch)	+++	LR-lc	115	<i>Mastacembelus armatus</i> (Lacepede)	+++	LR-nt
106	<i>Oreochromis mossambica</i> (Peters)	++++	INTR	116	<i>Macrogathus guentheri</i> (Day)	+++	LR-nt
	22. Family: Gobiidae				ORDER X: Tetraodontiformes		
107	<i>Glossogobius giuris</i> (Ham.)	++++	LR-lc		27. Family: Tetraodontidae		
*108	<i>Sicyopterus griseus</i> (Day)	+	EN	117	<i>Tetraodon travancoricus</i> Hora and Nair	+++	VU

CR - Critically Endangered; EN - Endangered; VU - Vulnerable; LR-nt - Low Risk-nearly threatened;
LR-lc - Low Risk-least concern; INTR - Introduced; + = Very rare; ++ = Rare; +++ = Common;
++++ = Very common; * = Critically endangered / Endangered species

TABLE 2
LIST OF CRITICALLY ENDANGERED AND ENDANGERED FISHES AND THEIR DISTRIBUTION IN
SOUTHERN KERALA

No.	Name of Species	Distribution	No.	Name of Species	Distribution
1	<i>Pisodonophis boro</i> (Ham.)	Periyar and Achankovil rivers	13	<i>Garra mccllellandi</i> (Jerdon)	Chalakydy, Bharathapuzha and Periyar rivers
2	<i>Hypselobarbus thomassi</i> (Day)	Periyar river	14	<i>G. menoni</i> Rema Devi & Indra	Pambar river
3	<i>Osteobrama cotio peninsularis</i> Silas	Periyar river	15	<i>G. hughi</i> Silas	Pambar river
4	<i>Osteochilus longidorsalis</i> Pethiyagoda and Kottelat	Chalakydy river	16	<i>G. surendranathanii</i> Shaji <i>et al.</i>	Chalakydy, Periyar and Pamba rivers
5	<i>O. nashii</i> (Day)	Periyar river	17	<i>Horallabiosa joshuai</i> Silas	Pambar river
6	<i>O. thomasii</i> (Day)	Periyar river	18	<i>Balitora mysorensis</i> Hora	Bharathapuzha river
7	<i>Puntius melanostigma</i> (Day)	Achankovil river	19	<i>Travancoria jonesi</i> Hora	Chalakydy and Periyar rivers
8	<i>P. ophicephalus</i> Raj	Periyar river	20	<i>Nemacheilus pambarensis</i> Rema Devi and Indra	Pambar river
9	<i>Chela fasciata</i> Silas	Bharathapuzha river	21	<i>N. evezardi</i> (Day)	Pambar river
10	<i>Salmostoma clupeoides</i> (Bloch)	Chalakydy and Periyar rivers	22	<i>N. keralensis</i> Rita <i>et al.</i>	Periyar and Muvattupuzha rivers
11	<i>Barilius canarensis</i> (Jerdon)	Bharathapuzha and Manimala rivers	23	<i>N. monilis</i> Hora	Pambar river
12	<i>Esomus thermoicos</i> (Val.)	Bharathapuzha river			

TABLE 2 (CONTD.)
LIST OF CRITICALLY ENDANGERED AND
ENDANGERED FISHES AND THEIR DISTRIBUTION
IN SOUTHERN KERALA

No.	Name of Species	Distribution
24	<i>N. semiarmatus</i> (Day)	Pambar river
25	<i>Pangio goaensis</i> (Tilak)	Manimala river
26	<i>Horabagrus nigricollaris</i> Pethiyagoda and Kottelat	Chalakydy river
27	<i>Batasio travancoria</i> Hora and Law	Pamba, Manimala, and Periyar rivers
28	<i>Mystus bleekeri</i> (Day)	Neyyar river
29	<i>M. montanus</i> (Jerdon)	Periyar river
30	<i>M. punctatus</i> (Jerdon)	Karuvannur river
31	<i>M. vittatus</i> (Bloch)	Periyar river
32	<i>Ompok malabaricus</i> (Val.)	Chalakydy and Karuvannur rivers
33	<i>Pseudeutropius mitchelli</i> Günther	Periyar river
34	<i>Glyptothorax annandalei</i> (Hora)	Muvattupuzha river
35	<i>G. lonah</i> (Sykes)	Chalakydy river
36	<i>Sicyopterus griseus</i> (Day)	Chalakydy and Periyar rivers

ACKNOWLEDGEMENTS

We thank the U. S. Fish and Wildlife Service and the Ministry of Environment and Forests for sponsoring the project on 'Ecology of hill streams of the Western Ghats with special reference to fish community' this paper is an outcome of the project. We are grateful to Mr. J. C. Daniel, Honorary Secretary, Dr. Asad R. Rahmani, Director and Dr. B.F. Chhapgar of the BNHS for encouragement and the State Forest Department of Kerala for permission and help to carry out collections. We thank Dr. Neil B. Armantrout, U.S. Fish and Wildlife Service, and Dr. K. Rema Devi, Scientist, Zoological Survey of India, Chennai for discussions, Dr. R. Sugathan, Scientist, Sálím Ali Wild Wings Trust, Thattakad Bird Sanctuary and Dr. N.D. Inasu, Department of Zoology, Christ College Irinjalakkuda, for help.

REFERENCES

- AJITHKUMAR, C.R., K. REMA DEVI, K. RAJU THOMAS & C.R. BIJU (1999): Fish fauna, abundance and distribution in Chalakydy river, Kerala. *J. Bombay nat. Hist. Soc.* 96(2): 244-254.
- BHIMACHAR, B.S. (1945): Zoogeographical divisions of the Western Ghats, as evidenced by the distribution of the hillstream fishes. *Curr. Sci.* 1: 12-16.
- BIJU, C.R., K. RAJU THOMAS & C.R. AJITHKUMAR (1999): Fishes of Parambikulam Wildlife Sanctuary, Palakkad District, Kerala. *J. Bombay nat. Hist. Soc.* 96(1): 82-87.
- DATTA MUNSHI, J.S. & M.P. SRIVASTAVA (1988): Natural History of Fish and Systematics of Freshwater Fishes of India. Narendra Publishing House, New Delhi.
- DAY, F. (1865): The fishes of Malabar. Bernard Quaritch, London. Repr. Bishen Singh Mahendra Pal Singh, Dehra Dun.
- EASA, P.S & C.P. SHAJI. (1996): Freshwater fishes of Pambar river, Chinnar Wildlife Sanctuary, Kerala. *J. Bombay nat. Hist. Soc.* 93: 304-306.
- GADGIL, M. & V.M. MEHER-HOMJI (1990): Ecological Diversity. In: Conservation in Developing Countries — Problems and Prospects (Eds. Daniel, J.C. and J.S. Serrao). Bombay Natural History Society, Mumbai. Pp. 175-198.
- HERRE, A.W.C.T. (1942): *Glyptothorax housei*, a new Sisorid catfish from South India. *Stanford Ichth. Bull.* 2(4): 117.
- HORA, S.L. & N.C. LAW (1941): The freshwater fishes of Travancore. *Rec. Ind. Mus* 43: 234-256.
- JAYARAM, K.C. (1981): Freshwater fishes of India. A handbook of the Zoological Survey of India, Calcutta. pp. 475.
- JAYARAM, K.C. (1999): Freshwater fishes of the Indian Region. Narendra Publishing House, Delhi, India. Pp. 551.
- JOHN, C.C. (1936): Freshwater fishes of Travancore. *J. Bombay nat. Hist. Soc.* 38: 702-733.
- MENON, A.G.K. (1950): On a remarkable blind Sisorid fish of the Family Clariidae from Kerala (India). *Rec. Ind. Mus.* 48: 59-69.
- MENON, A.G.K. (1951): Notes on fishes in the Indian Museum XLVL: On a new fish of the genus *Labuca* from Cochin. *Rec. Ind. Mus.* 49: 14.
- MENON, A.G.K. & K. REMA DEVI (1995): *Hypselobarbus kurali* (Pisces: Cyprinidae), a new large barb from the southwestern rivers of Peninsular India. *J. Bombay nat. Hist. Soc.* 92(3): 389-393.
- MENON, A.G.K. & P.C. JACOB (1996): *Crossocheilus periyarensis*, a new Cyprinid fish from Thanikkudy

- (Thekkady), Kerala, India. *J. Bombay nat. Hist. Soc.* 93(1): 62-64.
- MENON, A.G.K. (1998): Checklist of freshwater fishes of India. Zoological Survey of India, Calcutta.
- NAIR, S.C. (1991): The Southern Western Ghats - A Biodiversity Conservation Plan, INTACH, New Delhi.
- PETHIYAGODA, R. & M. KOTTELAT (1994): Three new species of fishes of the genera *Osteochilichthys* (Cyprinidae), *Travancoria* (Balitoridae) and *Horabagrus* (Bagridae) from the Chalakudy River, Kerala, India. *J. South Asian nat. Hist.* 1: 97-116.
- PILLAY, R.S.N. (1929): A list of fishes taken in Travancore. *J. Bombay nat. Hist. Soc.* 33: 347-379.
- RAJU THOMAS, K., C.R. BIJU, C.R. AJITHKUMAR & M. JOHN GEORGE (1999): Ichthyofauna of Eravikulam National Park with notes on trout culture in Rajamalai, Munnar, Kerala. *J. Bombay nat. Hist. Soc.* 96(2): 199-202.
- RAJU THOMAS, K., C.R. BIJU, C.R. AJITHKUMAR & M. JOHN GEORGE (2000a): Fishes of Chimmony and Peechi-Vazhani Wildlife Sanctuaries, Thrissur district, Kerala. *J. Bombay nat. Hist. Soc.* 97(2): 289-292.
- RAJU THOMAS, K., C.R. BIJU. & M. JOHN GEORGE (2000b): Fish fauna of Idukki and Neyyar Wildlife Sanctuaries, southern Kerala, India. *J. Bombay nat. Hist. Soc.* 97(3): 443-446.
- RAJ, S.B. (1941): A new genus of Schizothoracine fishes from Travancore, South India. *Rec. Ind. Mus.* 43: 209-214.
- REMA DEVI, K. & T.J. INDRA (1984): *Noemacheilus pambarensis*, a new loach (Cyprinoidei: Balitoridae: Noemacheilinae) from Western Ghats, Idukki, Kerala. *Rec. zool. Surv. India* 94 (2&4): 207-210.
- REMA DEVI, K. & A. G. K. MENON (1992): *Horadandia atukorali brittani*, a new subspecies of Rasborinae (Pisces: Cyprinidae) from Kerala, South India. *Trop. Fish Hobbyist* 65: 175-176.
- RITA, S.D., P. BANERESCU & T.T. NALBANT (1978): *Oreonectes (Indoreonectes) keralensis*, a new subgenus and species of loach from Kerala, India (Pisces: Cobitidae). *Trav. Mus. Hist. Nat.* 19: 185-188.
- SILAS, E.G. (1950): On a collection of fish from Travancore. *J. Bombay nat. Hist. Soc.* 48: 792-797.
- SILAS, E.G. (1951): On a collection of fishes from the Anamalai and Nelliampathi hill ranges (Western Ghats) with notes on its zoogeographical significance. *J. Bombay nat. Hist. Soc.* 49: 670-681.
- SILAS, E.G. (1952): Fishes from the High Ranges of Travancore. *J. Bombay nat. Hist. Soc.* 50: 323-330.
- SILAS, E.G. (1954): *Garra hughi*, a new Cyprinid fish from the Western Ghats, Peninsular India, with notes on its bionomics. *Rec. Ind. Mus.* 52: 1-14.
- SILAS, E.G. (1958): Studies on the Cyprinid fishes of the genus *Chela* Hamilton. *J. Bombay nat. Hist. Soc.* 55(1): 54-99.
- TALWAR, P.K. & A.G. JHINGRAN (1991): Inland fishes of India and adjacent countries. Oxford & IBH Publishing Co. Pvt. Ltd., New Delhi.
- ZACHARIAS, V. J., A.K. BHARADWAJ & P.C. JACOB (1996): Fish fauna of Periyar Tiger Reserve. *J. Bombay nat. Hist. Soc.* 93 (1): 39-43.

